

What is claimed is:

1. 1. An X-ray generating apparatus, comprising:
 - 2 a semiconductor structure;
 - 3 an emitter formed on the semiconductor structure, the emitter to emit electrons; and
 - 4 an element to generate X-rays in response to impact by the electrons on the element.
- 1 2. The X-ray generating apparatus of claim 1, further comprising a deflecting mechanism to deflect a path of the electrons.
- 1 3. The X-ray generating apparatus of claim 2, wherein the deflecting mechanism is adapted to deflect the electrons from a first path to a second path, the first path being at a non-zero angle with respect to the second path.
- 1 4. The X-ray generating apparatus of claim 3, wherein the deflecting mechanism is adapted to generate an electric field to deflect the electrons.
- 1 5. The X-ray generating apparatus of claim 3, wherein the deflecting mechanism is adapted to generate a magnetic field to deflect the electrons.
- 1 6. The X-ray generating apparatus of claim 1, wherein the emitter comprises a field emitter.
- 1 7. The X-ray generating apparatus of claim 1, wherein the emitter comprises a pointed tip and elements to apply an electric field to cause emission of electrons from the pointed tip.
- 1 8. The X-ray generating apparatus of claim 7, wherein the emitter further comprises a lens element to focus the electrons emitted from the pointed tip.
- 1 9. The X-ray generating apparatus of claim 7, wherein the emitter further comprises a lens element to collimate the electrons emitted from the pointed tip.

1 10. The X-ray generating apparatus of claim 1, further comprising an accelerator having
2 electrodes formed on the semiconductor structure, the accelerator to accelerate the electrons.

1 11. The X-ray generating apparatus of claim 10, further comprising a magnetic device to
2 apply a magnetic field to cause the electrons to travel in a curved path.

1 12. The X-ray generating apparatus of claim 11, wherein the accelerator is positioned to
2 be immersed in the magnetic field.

1 13. The X-ray generating apparatus of claim 11, further comprising circuitry to apply
2 alternating current (AC) signals to the electrodes.

1 14. The X-ray generating apparatus of claim 13, wherein the accelerator comprises a
2 cyclotron.

1 15. The X-ray generating apparatus of claim 11, wherein the magnetic field varies
2 radially along a direction in a plane parallel to a surface of the semiconductor structure.

1 16. The X-ray generating apparatus of claim 10, further comprising a second
2 semiconductor structure and additional electrodes formed on the second semiconductor
3 structure, the additional electrodes being part of the accelerator.

1 17. The X-ray generating apparatus of claim 16, wherein the semiconductor structures
2 comprise semiconductor dies.

1 18. The X-ray generating apparatus of claim 16, wherein the semiconductor structures
2 have respective surfaces that are generally parallel to each other, the X-ray generating
3 apparatus further comprising a deflecting mechanism to deflect the electrons from a first path
4 to a second path,
5 the second path being generally parallel to the surfaces of the semiconductor
6 structures.

1 19. The X-ray generating apparatus of claim 1, wherein the element is formed of a
2 material containing tungsten.

1 20. The X-ray generating apparatus of claim 1, wherein the element is formed of a
2 material containing molybdenum.

1 21. A method of generating X-rays, comprising:
2 activating an emitter on a semiconductor structure to emit electrons; and
3 directing the electrons onto a target to cause the target to generate X-rays.

1 22. The method of claim 21, wherein activating the emitter comprises generating an
2 electric field to cause emission of electrons from a pointed tip in the emitter.

1 23. The method of claim 22, further comprising collimating the emitted electrons using a
2 lens element.

1 24. The method of claim 21, further comprising deflecting the emitted electrons from a
2 first path to a second path.

1 25. The method of claim 24, further comprising accelerating the electrons traveling in the
2 second path to increase an energy of the electrons prior to impact of the electrons onto the
3 target.

1 26. The method of claim 25, wherein accelerating the electrons comprises accelerating the
2 electrons with an accelerator having electrodes formed on the semiconductor structure.

1 27. The method of claim 26, further comprising applying a magnetic field, the accelerator
2 immersed in the magnetic field.

1 28. The method of claim 27, further comprising varying the magnetic field radially from a
2 point on the semiconductor structure across a plane parallel to a surface of the semiconductor
3 structure.

1 29. An X-ray source device, comprising:
2 a housing defining a chamber;
3 a semiconductor structure disposed in the chamber, the chamber containing a vacuum;
4 a field emitter formed on the semiconductor structure to emit electrons; and
5 a target in the chamber to generate X-rays in response to impact by the electrons.

1 30. The X-ray source device of claim 29, further comprising an accelerator having
2 electrodes formed on the semiconductor structure, the accelerator to accelerate the electrons
3 prior to impact on the target.

1 31. The X-ray source device of claim 30, further comprising a magnetic device to
2 generate a magnetic field to cause the electrons to travel in a curved path as the electrons are
3 accelerated by the accelerator.

1 32. An X-ray source device, comprising:
2 a housing defining a chamber;
3 at least two semiconductor structures disposed in the chamber, the chamber
4 containing a vacuum, the at least two semiconductor structures being generally parallel to
5 each other;
6 a field emitter formed on one of the at least two semiconductor structures to emit
7 electrons;
8 a deflecting mechanism in the chamber to deflect the electrons from a first path to a
9 second path; and
10 a target in the chamber to generate X-rays in response to impact by the electrons.